CLAIMS

We claim:

1. A method for measuring a thickness of a thin film formed on a top surface of a substrate comprising:

a) measuring a film thickness at a single point on said top surface of said substrate using an interferometry with a measuring light beam having a range of wavelengths;

b) selecting an optimal wavelength within said range of wavelengths applied for measuring said film thickness at said single point;

c) measuring reflection intensities by scanning over a plurality of points with a measuring light beam of said optimal wavelength over said top surface of said substrate; and

d) determining a film thickness of said plurality of points using said reflection intensities measured from scanning over said plurality of points with said measuring light beam of said optimal wavelength over said top surface of said substrate.

2. The method of claim 1 wherein:

said step d) of determining a film thickness at said plurality points over said top surface of said substrate including a step of determining an offset of said reflection intensities at each of said plurality of points from a reflection intensity of said single point measured in said step a).

3. The method of claim 1 wherein:

said step a) of measuring said film thickness at said single point is a step of employing a spectrophotometer; and

said step c) of measuring reflection intensities by scanning over a plurality points with a measuring light beam of said optimal wavelength over said top surface of said substrate is a step of employing a densitometer for scanning over a plurality points over said top surface.

4. The method of claim 1 wherein:

said step a) of measuring said film thickness at said single point using an interferometry with a measuring light beam having a range of wavelengths is a step of employing a color filter, such as a defraction grating and a scanning slit, for adjusting over said range of wavelengths;

said step c) of measuring reflection intensities by scanning over a plurality of points with a measuring light beam of said optimal wavelength over said top surface of said substrate is a step of employing said interferometry detector by fixing said detector to measure only said optimal wavelength for scanning over a plurality of points over said top surface.

5. The method of claim 1 wherein:

said step b) selecting an optimal wavelength within said range of wavelengths is a step of determining a sensitivity of reflectance change at different wavelengths and selecting said optimal wavelength having a highest sensitivity of reflectance change.

6. The method of claim 1 wherein:

said step b) selecting an optimal wavelength within said range of wavelengths is a step of selecting an optimal wavelength functionally related to said film thickness measured at said single point and a refractive index of said thin film.

7. The method of claim 1 wherein:

said step a) of measuring a film thickness at a single point on said top surface of said substrate is a step of measuring a film thickness at a center of said substrate; and

said step b) selecting an optimal wavelength within said range of wavelengths is a step of selecting an optimal wavelength λ_s functionally proportional to said film thickness T_c at said center of said substrate and refractive index n of said thin film substantially according to a relationship of $\lambda_s = K\, nT_c$ where K is a constant determined for specific film thickness ranges.

8. A method for measuring a thickness of a thin film formed on a top surface of a substrate comprising:

spectral scanning a single point on said top surface of said substrate followed by selecting a single wavelength for spatial scanning over a plurality of points of said top surface for determining a thickness profile of said thin film.

9. The method of claim 8 wherein:

said step of selecting a single wavelength is a step of selecting an optimal wavelength functionally related to a film thickness measured at said single point by said spectral scanning and the refractive index of said thin film.

10. An apparatus for measuring a thickness of a thin film formed on a top surface of a substrate comprising:

an interferometry means for measuring a film thickness at a single point on said top surface of said substrate employing a measuring light beam having a range of wavelengths;

a computing means for selecting an optimal wavelength within said range of wavelengths applied for measuring said film thickness at said single point;

a scanning means for scanning over a plurality of points over said top surface with said optimal wavelength; and

a film thickness determination means for collecting a reflection intensity from each of said point scanned with said optimal wavelength for determining a thickness at each of said plurality of points over said top surface of said substrate.

11. The apparatus of claim 10 wherein:

said film thickness determination means further includes a thickness offset determination means for determining a thickness offset at each of said plurality points relative to said single point.

12. The apparatus of claim 10 wherein:

said interferometry means for measuring said film thickness at said single point is a spectrophotometer; and

said thin film determination means is a densitometer for scanning over a plurality points over said top surface.

13. The apparatus of claim 10 wherein:

said interferometry means includes a defraction grating and scanning slit for adjusting said measuring beam at said single point over said range of wavelengths; and

said thickness determination means includes a defraction grating and scanning slit fixing means for fixing said scanning slit corresponding to said optimal wavelength for scanning over a plurality points over said top surface.

14. The apparatus of claim 10 wherein:

said computing means includes a reflectance sensitivity computing means for determining a sensitivity of reflectance change at different wavelengths and selecting said optimal wavelength having a highest sensitivity of reflectance change.

15. The apparatus of claim 10 wherein:

said computing means includes an optimal wavelength selecting means for selecting an optimal wavelength functionally related to said film thickness measured at said single point and a refraction index of said thin film.

16. The apparatus of claim 10 wherein:

said interferometry means further includes a moving stage for moving said interferometry means to different position over said top surface of said substrate; and

said computing means includes an optimal wavelength selecting means for selecting an optimal wavelength λ_s functionally proportional to a film thickness Tc measured at a center of said substrate and a refractive index n of said thin film substantially according to a relationship of $\lambda_s = K\, nT_c$ where K is a constant for specific film thickness ranges.

17. An apparatus for measuring a thickness of a thin film formed on a top surface of a substrate comprising:

a spectral scanning means for scanning a single point on said top surface of said substrate with a range of wavelengths and a spatial scanning means for spatially scanning over a plurality of points of said top surface with a single wavelength for determining a thickness profile of said thin film.

18. The apparatus of claim 17 further comprising:

a computing means for selecting said single wavelength functionally related to a film thickness measured at said single point and refractive index of said thin film.